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Boharticus, N. Gen., with a Review of *Rhopalicus* Foerster and *Dinotiscus* Ghesquiere (Hymenoptera: Pteromalidae)

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This paper represents a preliminary step toward integrating knowledge of the Nearctic and Palearctic faunas of Pteromalidae. It presents a review of the known species of *Rhopalicus* Foerster and *Dinotiscus* Ghesquiere, in which a new Nearctic species of *Rhopalicus* is described (*zolae*), the Palearctic species *Dinotiscus aponius* is reported for the first time from the Nearctic, two Nearctic species of *Dinotiscus* (*acutus, polygraphi*) are synonymized under a Palearctic name (*D. eupterus*), the Nearctic species *D. burkei* is synonymized with *D. dendroctoni,* and keys to the 11 known species of both genera are given. All species are associated with wood-infesting beetles. Additionally, the new genus *Boharticus* is described for 4 new species associated with Cecidomyiidae on *Juniperus.*

The findings of this paper are based upon a comparison of type-specimens and identified material from both the British Museum (Natural History) (hereafter BMNH) and the United States National Museum (USNM). Additional material was borrowed from the Florida State Collection of Arthropods (FSCA), Gainesville, Florida. Host records are mainly from Burks (1979) and Graham (1969), but nomenclatural changes for these records have been made based upon newly published references (Wood, 1982; O'Brien and Wibmer, 1982). In the case of generic synonymy, I have relied upon the taxonomic conclusions reached by Graham (1969) who, for many years, has studied the types of European Pteromalidae. His research furnishes a base for much future pteromalid work.

Many years ago, when I began my chalcidoid studies, I desperately needed a starting point such as that provided by Graham (1969). By taking up a group wherein scarcely anyone was working, I assured myself of one thing . . . no help whatsoever! At least it seemed that way at the time. But upon the deliberations of numerous passing years, I now realize that I really did have one resource of help and a steady one at that. It was the source of direction, of purpose, and of inspiration that came from Dick Bohart, an entomologist's entomologist. Without "Doc" there somewhere, always willing to help, I should surely have stumbled once too often. Dick and his wife, Margaret, were generous to me in particular, and to their students in general. I take great satisfaction in dedicating this work to both of them.

PTEROMALID CLASSIFICATION

Before presenting the descriptive aspects of this paper, a few general comments should be made about the state of our knowledge of pteromalid taxonomy. Current world figures place the number of valid pteromalid species at 3111 and the number of genera at 611 (J. S. Noyes, pers. comm.). In the Nearctic there are nearly 400

species in 129 genera (Burks, 1979). These figures are misleadingly low if we consider the potential number of undescribed taxa and the fact that the group has been poorly collected and studied.

In the Nearctic there has been little revisionary work which would serve as a basis for the study of pteromalid taxonomy. In the Palearctic, however, Graham (1969) published a monograph of the Pteromalidae of northwestern Europe in which he provided keys to all European genera. Comparison of Graham's work with the most recent Nearctic catalog (Burks, 1979) shows that over two-thirds (ca. 80 of 110) of the genera treated by Graham are Holarctic. Therefore Graham's work could serve an important function in first helping us to understand the Nearctic fauna, and more importantly, in providing a starting point for the integration of the Nearctic and Palearctic faunas.

As important as Graham's work is, however, its indiscriminate use may cause problems. The description of the new genus *Boharticus* has highlighted some of these problems and I point them out here for precautionary reasons. To begin with, relationships of genera and diagnostic characters for them are not discussed in Graham's text. Although genera are apparently arranged in a phylogenetic system within the text, there is little or no discussion of relationships between them. To *define* genera it is therefore necessary to search through the keys for useful characters. However, when one does this for well-known genera with large numbers of species, such as *Chlorocytus* Graham, *Pteromalus* Swederus, and *Mesopolobus* Westwood (ca. 120 species total), it is apparent that they are not clearly defined. For example, these 3 genera run to 24 different couplets in the key. The conclusion one draws from this is that species grouped in each of these genera cannot be defined by shared, unique characters (i.e., synapomorphies). A more serious problem is that a large proportion of genera (54 of 128 Palearctic genera) are represented by only 1 species each and that these genera are often distinguished by a character (or combination of characters) which would be only of specific value in one of the larger three genera listed above. For example, characters associated with pronotal collar, clypeus, flagellomere ratios, color, and abdominal shape may be used to distinguish groups of species within genera (via numerous couplets in the key) as well as to define genera with single species.

The 4 species which I place in *Boharticus,* new genus, serve to illustrate the rather poor definitions and lack of understanding we have within the Pteromalidae. Running these species individually through Graham's key results in one being placed in *Dinotiscus* Ghesquiere, two being placed in *Rhopalicus* Foerster, and one being placed in *Trychnosoma* Graham. For reasons I will discuss under the description of *Boharticus*, I believe the species of this genus represent a natural grouping based upon thoracic and host-related characters. However, the act of defining *Boharticus* causes the distinctions between *Dinotiscus* and *Rhopalicus* to become unclear. That is, the latter two genera now are defined by characters which appear to be more appropriate for separating species. At present, I can do little to resolve the generic problems between *Rhopalicus* and *Dinotiscus*. Although I have seen all the species of these genera and I have provided a modification of Graham's key which will separate them, their true status will require a major taxonomic revision of the entire family. Such a revision will require analysis of new sets of characters (such as the thoracic characters used to define *Boharticus*) as well as reexamination of previously used ones.

Boharticus Grissell, New Genus

Type-species.—*Boharticus richardi* Grissell, new species.

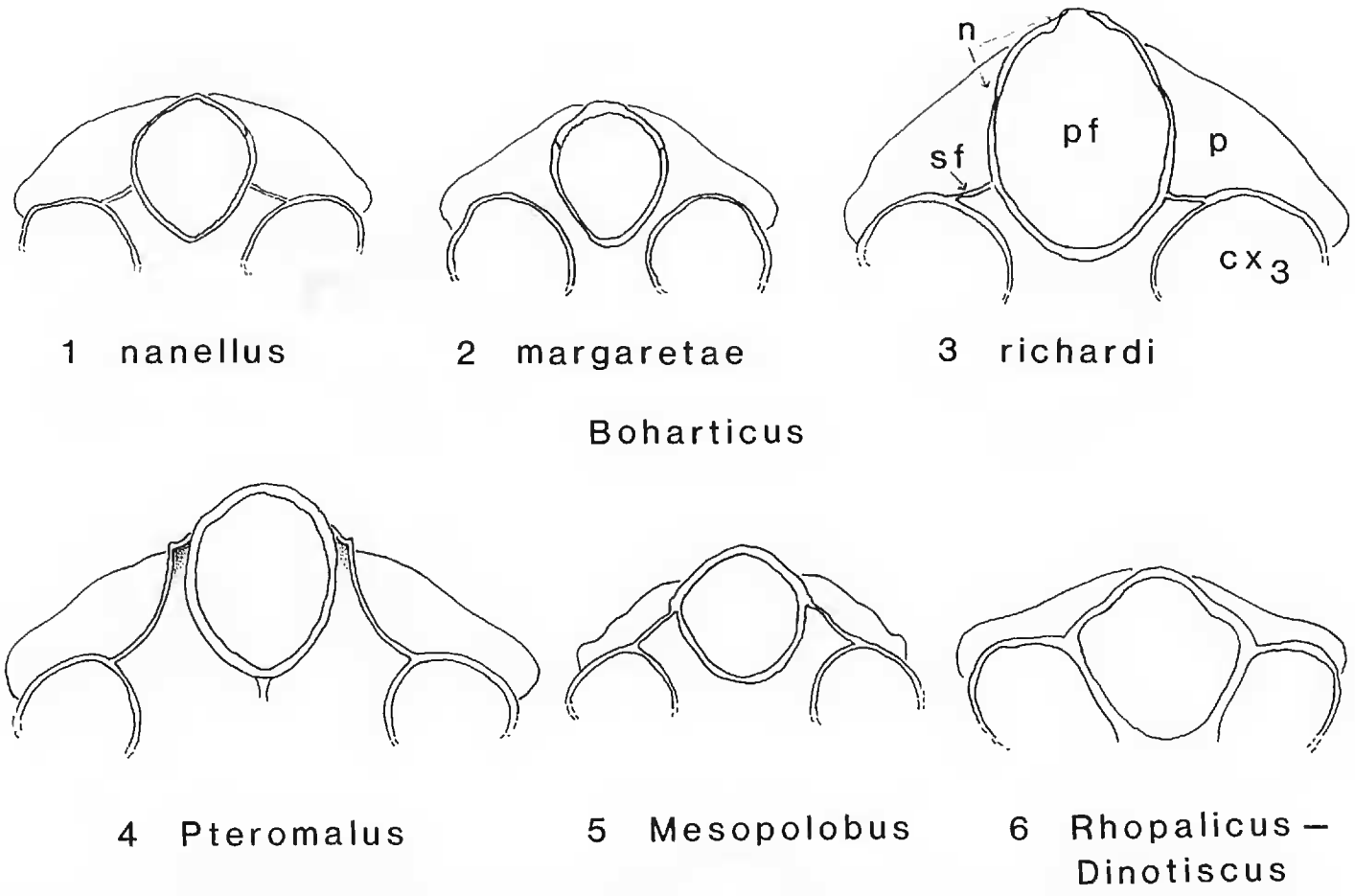
Occiput without carina; clypeus entire; lower face not protuberant at level of toruli; antenna with 2 anelli, 6 flagellomeres, and 3 segmented club; torulus 2 to 3 diameters above level of ventral margins of eyes; both mandibles with 3 denticles, uppermost denticle truncate. Almost entire thorax similarly and heavily reticulate including postalar plate (Fig. 12), upper epimeron, dorsellum, and propodeum; scutum with notauli on anterior half; frenum weakly indicated by finer sculpture on area anterior to it; dorsellum well developed (i.e., not narrowed or reduced) and protruding at least as far as apex of scutellum, not separated from scutellum by costate groove; propodeum with or without complete median carina, without plicae or costula; nucha represented by narrow, lunate strip which may be triangularly enlarged medially in some species (e.g., Fig. 11); supracoxal flange not joined to nucha (but may be joined to inner one-third of petiolar foramen, Figs. 1, 3); hindcoxa with or without setae dorsally; forefemur not enlarged or emarginate ventrally; hind tibia with one apical spur; forewing with maculae, postmarginal and marginal veins longer than stigmal, postmarginal equal to or shorter than marginal, stigma not enlarged. Gaster lanceolate, petiole transverse and scarcely visible, terga entire on posterior margins, bristles of cerci equal in length, ovipositor not exserted, tip of hypopygium not (or barely) reaching middle of gaster.

Etymology.—Named in honor of Richard M. Bohart on the occasion of his 70th birthday. The gender is masculine.

Discussion.—The genus *Boharticus* is recognized as monophyletic based upon the following synapomorphies:

1) All species share a structurally unique thorax as follows:
   a) On the propodeum in dorsal view, the area between the nucha and the supracoxal flange is not connected by a carina (thus the propodeum appears to turn under at this point). In *B. margaretae* this connecting carina is absent (Fig. 2). In *B. richardi, nanellus,* and *apilosus,* however, the carina curves around the inner margin of the coxal cavity and joins the propodeal foramen in the inner one-third (Figs. 1, 3; compare this with Fig. 6 for *Rhopalicus* and *Dinotiscus*);
   b) The thorax is heavily and similarly reticulate on nearly every surface, but especially on the upper epimeron, the dorsellum, the postalar plate (Fig. 12), and the propodeum.
2) All species are associated biologically with gall-formers on the plant genus *Juniperus.* The gall-formers are known to be Cecidomyiidae for 3 species of *Boharticus.* The fourth species is known only from juniper "berries," but this is probably an error in identification because the galls of several cecidomyiids (e.g., *Walshomyia*) resemble fruiting structures.

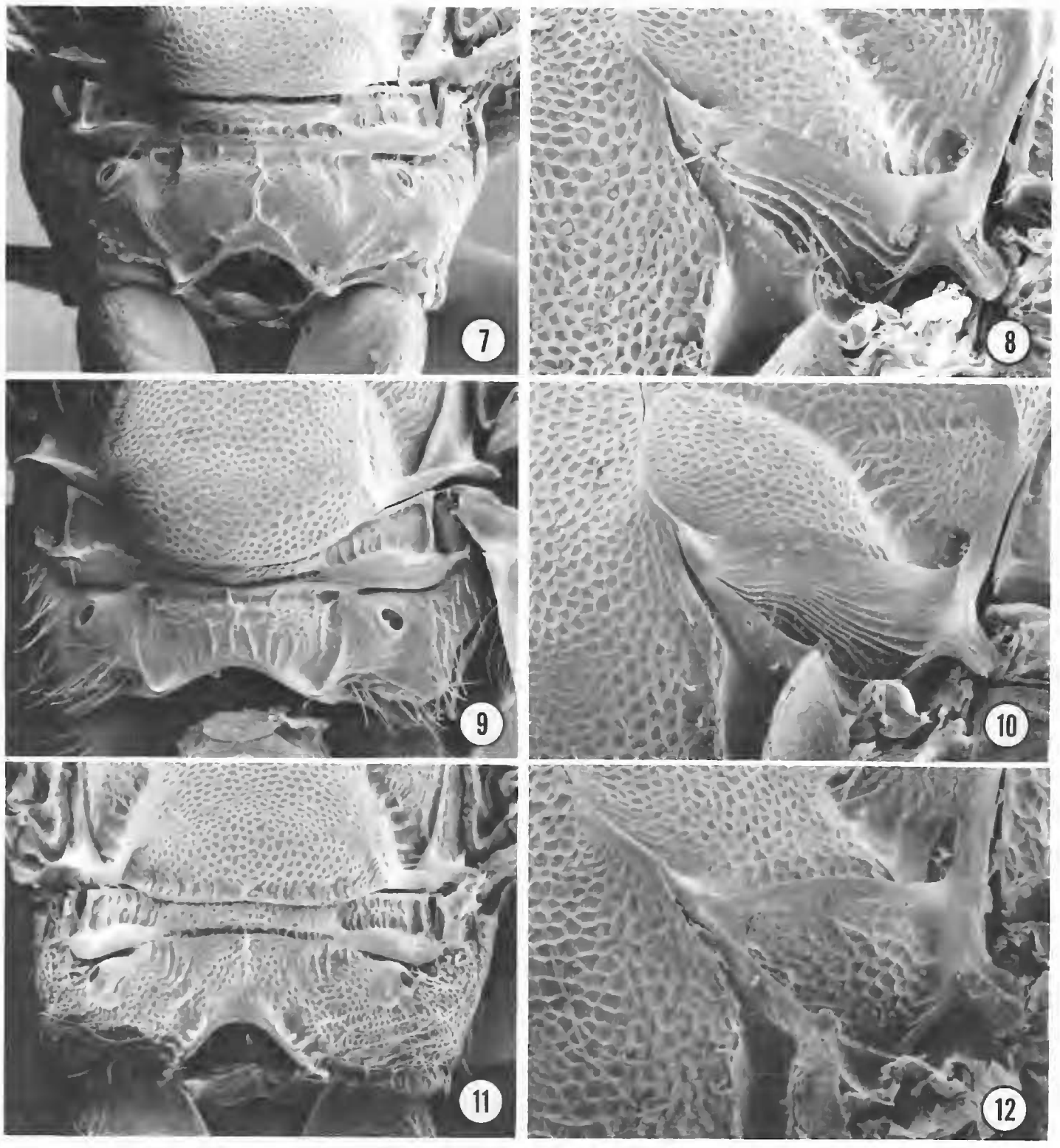
If the members of *Boharticus* are placed within the context of Graham (1969), 3 of the 4 species would key to couplet 205 which includes *Dinotiscus* and *Rhopalicus,* and the fourth would key to *Trychnosoma* Graham (couplet 110; for discussion see *B. apilosus* below). *Boharticus* differs from both *Rhopalicus* and *Dinotiscus* as follows:



Figs. 1–6. Ventral view of propodeum and posterior apex of thorax (*cx*3 = hindcoxal foramen; *n* = nucha; *p* = propodeum; *pf* = propodeal foramen; *sf* = supracoxal flange).

1) All species of these latter 2 genera (as well as other related Pteromalinae genera) share the following thoracic characters:
   a) In dorsal view, the supracoxal flange is connected to the nucha by a carina (ventrally the carina may be seen to join the nucha in the outer one-third, Fig. 6);
   b) The thorax is not everywhere heavily or evenly reticulate; at least the postalar plate (Figs. 8, 10) is vertically carinate (may be smooth on outer margin or with vertically elongate reticulations on inner margin), the upper epimeron and/or dorsellum may be smooth, and the propodeum is less heavily sculptured than the apex of the scutellum.
2) All species of these genera are parasitic upon wood-infesting beetles of the families Scolytidae and Curculionidae.

The propodeal character involving the supracoxal flange is not the easiest of characters to interpret, and I offer these additional notes as a guideline. Initially, in trying to assess the structure of the flange, it was necessary to remove the abdomen of each specimen for a better view. However, the flange may be seen in dorsal view, without removing the abdomen, by tilting the specimen forward. In genera such as *Dinotiscus* and *Rhopalicus* the flange is easily seen from this position (Figs. 7, 9) partially because it is well developed and partially because it is relatively near to the posterior margin of the propodeum (Fig. 6). In *Boharticus,* the flange is either absent (Fig. 2) or weakly developed and positioned toward the anterior of the propodeal foramen (Figs. 1, 3). In ventral view, and with the



Figs. 7–12. Scanning electron micrographs. 7, 8, *Rhopalicus pulchripennis.* 9, 10, *Dinotiscus thomsoni.* 11, 12, *Boharticus richardi.* (Left, propodeum; right, postalar plate.)

abdomen removed, the supracoxal flange of *Rhopalicus* and *Dinotiscus* is continuous with the nucha and there is virtually no sclerite between the propodeal foramen and the hindcoxal foramen (Fig. 6). In *Boharticus,* however, the supracoxal flange (if present) does not join the nucha, but instead joins the propodeal foramen and there is a sclerotized area between the propodeal and hindcoxal foramina (Figs. 1–3).

It is not known how useful this character will be throughout the Pteromalinae. However, in examining many species of *Mesopolobus* Westwood, which share the narrowed nucha of *Boharticus, Dinotiscus,* and *Rhopalicus,* it was found that the character was stable for the genus, although it was expressed in a manner intermediate (Fig. 5) to *Boharticus* (Fig. 1–3) and *Rhopalicus-Dinotiscus* (Fig. 6). In

Mesopolobus there is a sclerotized area between the foramina (as in *Boharticus*) but the supracoxal flange joins the nucha (as in *Rhopalicus-Dinotiscus*). In *Pteromalus,* a genus separated from the above mentioned genera by virtue of an elongate, sculptured nucha, the supracoxal flange is also consistently well developed, elongate, and joins the nucha as in *Mesopolobus* (cf. Figs. 4 and 5). This character is constant for the species of *Pteromalus* I have examined.

For practical purposes the following couplets are proposed to replace those numbered 205 to 206 in Graham (1969:387). This replacement is based upon all known species of *Boharticus, Dinotiscus,* and *Rhopalicus.*

205 (53, 124) Hindtibia with 2 apical spurs (Palearctic) . . *Acrocormus* Foerster
– Hindtibia with 1 apical spur 206
206 (205) Nearly entire thorax similarly and heavily reticulate (note especially postalar plate (Fig. 12), upper epimeron, dorsellum, and propodeum); supracoxal flange not joined directly to nucha (Figs. 1–3; may be joined to lower third of propodeal foramen), in dorsal view flange not easily seen . . . . . *Boharticus* Grissell
– Thorax not similarly reticulate throughout, postalar plate vertically carinate (Figs. 8, 10; may appear elongately reticulate towards inner margin and smooth along outer), epimeron may be smooth above, propodeum alutaceous medially or at least less heavily sculptured than apex of scutellum; supracoxal flange joined to nucha and visible in dorsal view (Figs. 7, 9) 207
207 (206) Pronotum carinate; propodeal nucha medially a semicircular, narrowed carina (Fig. 9) . . . . . *Dinotiscus* Ghesquiere
– Pronotum without carina; propodeal nucha medially expanded as triangular area (Fig. 7) . . . . . *Rhopalicus* Foerster

Key to Female *Boharticus*

1. Basal cell of forewing essentially bare (with 0 to 10 setae, but if questionable then wing spot parallels marginal vein and parastigma (Fig. 16)); pronotal collar carinate 2
– Basal cell of forewing fairly evenly setose (usually over 10 setae, but if questionable, as in some specimens less than 1 mm, then wing spot confined to stigmal area, Fig. 14); pronotum without carina 3
2. Hindcoxa with basal setae; forewing with maculae expanded at both stigmal and parastigmal areas (Fig. 13) . . . . . *margaretae* Grissell, n. sp.
– Hindcoxa without basal setae; forewing with macula expanded only at stigmal area (Fig. 16) . . . . . *apilosus* Grissell, n. sp.
3. Forewing macula surrounding stigmal vein and paralleling marginal vein (Fig. 15); abdomen about 3× as long as wide; nucha expanded medially as carina which reaches (or nearly) dorsum of propodeum (Fig. 11) . . . . . *richardi* Grissell, n. sp.
– Forewing macula restricted to stigmal area (Fig. 14); abdomen less than 1.5× as long as wide; nucha parallel-sided medially, not extending dorsally as carina . . . . . *nanellus* Grissell, n. sp.

Boharticus richardi Grissell, New Species
(Figs. 3, 11, 12, 15, 19)

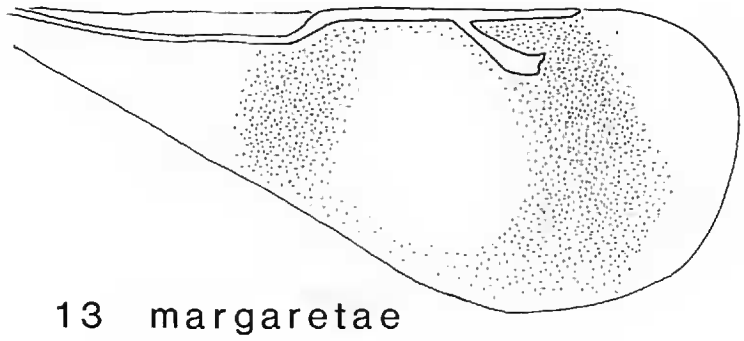
Holotype female.—Body length 5.8 mm. Head and thorax (excluding legs beyond coxae) metallic green; abdomen metallic red with green reflections; femora and tibiae smoky orange; scape, tegula, and tarsomeres 1–4 straw-yellow; antenna and tarsomere 5 brown, wing veins brown becoming slightly lighter towards postmarginal. Head, thorax, and abdomen (except posterior margin of terga nearly smooth) with reticulate sculpture. Face as shown in Fig. 19; toruli 2× own diameter above ventral margin of eyes (5:10); intermalar distance 2.1× malar distance (32:15); eye 2.3× length of malar distance (34:15); ratio of lateral ocellus diameter : ocellocular distance : postocellar distance as 5:10:14; ratio scape : pedicel : anelli : flagellomeres 1–6 : club as 50:14:3:3:17:16:16:14:13:13:27, flagellomeres starting 1.6× as long as wide (F1 = 16:10) and becoming as long as wide (F6 = 13:13). Pronotal collar not margined anteriorly, dropping almost perpendicularly to neck; nucha angled medially forming an acute triangle which narrows and continues to dorsal margin of propodeum (Fig. 11); basal fovea about size of spiracle and midway between spiracle and median carina, apical fovea about as large as basal one, 10–15 setae present posterior to spiracle, callus evenly setose; epimeral scrobe nearly straight, situated at midpoint of epimeron and occupying about $1/7$ of length; wing veins with ratio of submarginal : marginal : postmarginal : stigmal as 48:16:16:10; basal cell with at least 25 setae, setae present on cubital and basal veins, costal cell with complete anterior setal row beneath and several rows beneath on distal ⅓; maculations as shown in Fig. 15; hindcoxa with setae basally. Abdomen keel-shaped (i.e., somewhat laterally compressed but dorsally flat), with heavy, reticulate sculpture, with ratio of T1–7 : ovipositor sheaths as 15:10:8:8:12:17:15:3; ratio length : width as 43:14; ratio abdomen : thorax as 43:23.

Male.—Unknown.

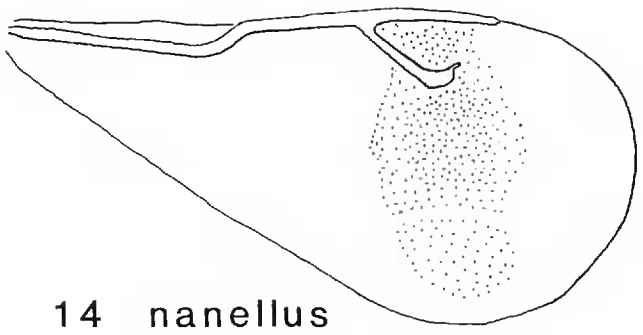
Type material.—Holotype ♀, USNM #100592; CALIFORNIA, *Fresno Co.*, Coalinga, 21 March 1960, H. L. Wilson, ex Juniper galls. Paratypes: 7 ♀, same data as holotype; 1 ♀, same data except 20 March 1959, ex "Juniper berries;" 3 ♀, CALIFORNIA, *Los Angeles Co.*, Vasquez Rocks, 25 January 1963, ex pine-cone gall on *Juniperus californica*; 2 ♀, CALIFORNIA, *Stanislaus Co.*, Del Puerto Canyon, E. E. Grissell, R. F. Denno, em. 15 March 1971 ex cecidomyiid cone gall on *Juniperus californica* collected 6 March 1971. All specimens in USNM except 2 ♀ in British Museum (Natural History). (The "pine-cone" gall is made by a species of Cecidomyiidae in the genus *Walshomyia* according to R. J. Gagne, personal communication. The juniper "berry" record is probably a mistake, as some *Walshomyia* galls have the appearance of a fruiting structure.)

Etymology.—Named for Richard M. Bohart, mentor, colleague, and friend.

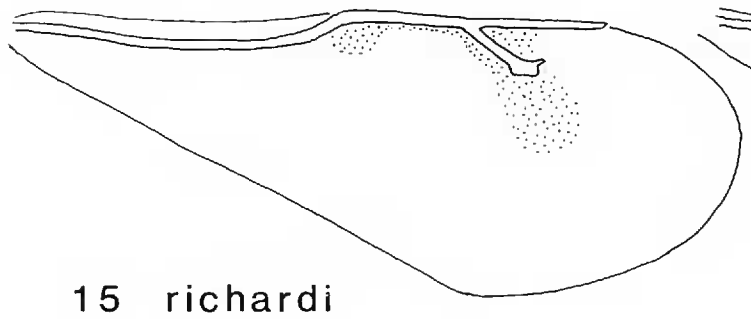
Variation.—Females of *B. richardi* range in length from 4.9 to 6.2 mm. Color of the head and thorax is metallic green in most specimens (15) but 1 specimen is metallic blue. The abdomen is metallic red in 13 specimens and metallic green tinged red in 2. The maculation pattern of the forewing is consistent, but the intensity varies from very dark brown (with distinct edges) to a washed out brown (with indistinct edges, i.e., the pattern fades into the surrounding clear areas). The number of setae of the basal cell is variable, but the cell is fairly evenly covered with 20 or more setae. All the specimens have the nucha extended dorsally as a keel or carina, but in 2 specimens this carina fades toward the dorsal propodeal



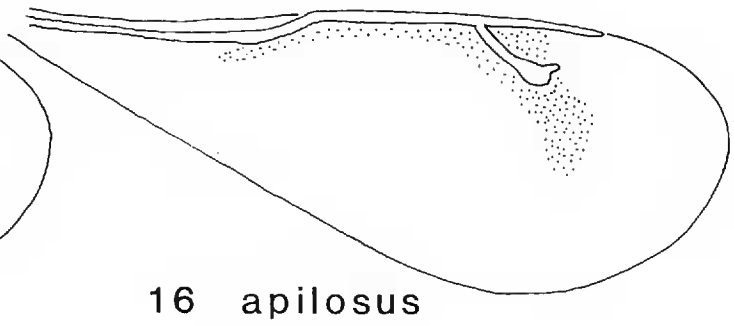
13 margaretae



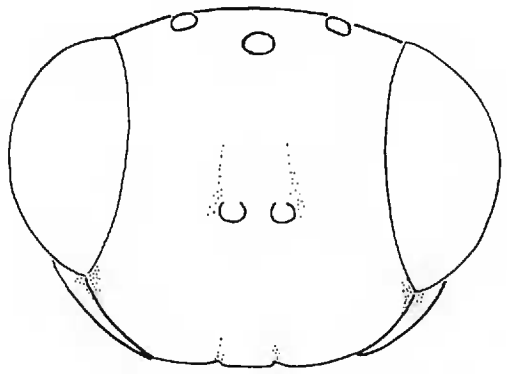
14 nanellus



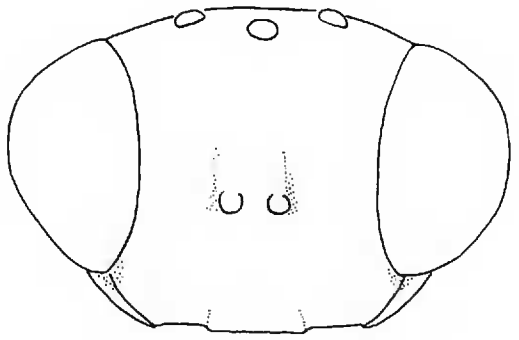
15 richardi



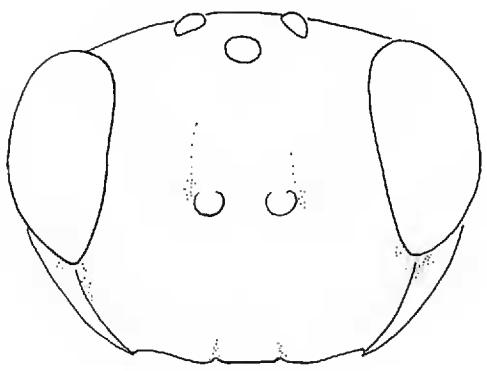
16 apilosus



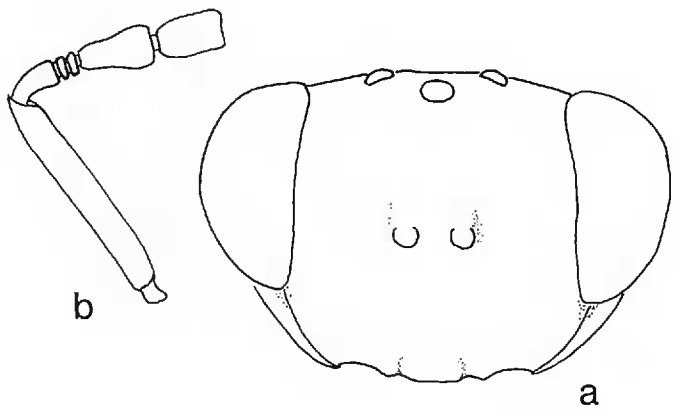
17 margaretae



18 nanellus



19 richardi



20 apilosus

Figs. 13–20. *Boharticus* n. spp. 13–16, forewing (setae not shown). 17–20, face, frontal view; 20b, scape, pedicel, anelli, flagellomeres 1 and 2.

margin and does not reach it. The specimens from Del Puerto Canyon have the nucha less pronounced than other specimens, but the carina continues to the propodeal margin. The basal fovae very from a simple depression about the size of the spiracle to a depression several times as large with 2 or 3 carinae present. The epimeral scrobe may be short as in the holotype or it may occupy half of the epimeral length.

Discussion.—This is the most striking member of the genus. It is the largest species (to over 6 mm), and the abdomen is generally metallic red which contrasts distinctly with the green thorax. The abdomen is considerably elongate (3× longer than wide, 2× longer than the thorax), keel-shaped, and as heavily sculptured as the thorax. Although *richardi* shares the setose basal cell with *nanellus,* the two do not appear particularly related. They differ in a number of characters as follows: in *richardi* the eye height is less than 2.5× the malar distance (nearly 3.5× in *nanellus*), F1 is over 1.5× longer than wide and the flagellomeres become quadrate at F6 (F1 is quadrate in *nanellus,* and flagellomeres become wider than long by F6), the fore and midcoxae are green (yellow in *nanellus*), the abdomen is keel-shaped and flat dorsally with heavy, reticulate sculpture (dorso-ventrally sunken in *nanellus*), and T1 and 7 are subequal (T1 is 2.5× as long as T7 in *nanellus*). Additional characters may be found in the key.

Boharticus margaretae **Grissell, New Species**
(Figs. 2, 13, 17)

Holotype female.—Body length 3.0 mm. Head and thorax (excluding legs beyond coxae) metallic green; abdomen blackish purple; femora, tibiae, and tegula, smoky orange; scape and tarsi straw-yellow; antenna and wing veins brown, forewing with 2 brown spots. Head, thorax, and abdomen (except posterior margins of terga smooth) covered with reticulate sculpture. Face as shown in Fig. 17; toruli 2.7× own diameter above ventral margin of eyes (6:16); intermalar distance 2.3× malar distance (21:9); eye 2.9× length of malar distance (26:9); ratio of lateral ocellus diameter : ocellocular distance : postocellar distance as 6:12:21; ratio scape: pedicel : anelli : flagellomeres 1–6 : club as 40:14:2:2:10:9:9:9:9:8:17, flagellomeres starting slightly longer than wide (F1 = 9:7) and becoming slightly wider than long (F6 = 9:8). Pronotal collar margined anteriorly, dropping almost perpendicularly to the neck, collar laterally rounded off; nucha evenly curved and parallel-sided medially, disappearing at lateral edges, basal foveae essentially absent, apical fovea well developed, 3 or 4 long setae present posterior to inner margin of spiracular sulcus, callus with about 5 setae; epimeral scrobe a long, crescentric groove reaching from near posterior margin to anterior margin; wing veins with ratio of submarginal : marginal : postmarginal : stigmal as 45:21:19:14; basally, cubital and basal veins without setae, wing essentially bare from speculum to base (only a few setae present near intersection of cubital and basal veins, and costal cell with anterior row beneath); maculations as shown in Fig. 13; hindcoxa with setae basally. Abdomen keel-shaped, dorsally flattened, with reticulate sculpture, with ratio T1–7 : ovipositor sheaths as 12:12:14:13:10:8:7:6; ratio length : width as 40:18; ratio abdomen : thorax as 40:26.

Male—Unknown.

Type material.—Holotype female, USNM #100593; COLORADO, *El Paso Co.,* Garden of the Gods, 20 July 1915, J. H. Pollock, [ex "cecidomyiid larvae

in old buds"], *Juniperus monosperma,* "Hopkins U. S. 12946a." Paratypes: 8 ♀, same data as holotype; 1 ♀, ARIZONA, *Mohave Co.;* 8 miles SW Peach Springs, 4500′, 7 September 1964, C. W. O'Brien, ex *Juniperus.* All specimens in USNM, except 1 ♀ in British Museum (Natural History). (Note: The bracketed material above was taken from Hopkins cards on file at the USNM; according to these cards, the gall material was collected on 1 July 1915 and parasites emerged on 20 July.)

Etymology.—This attractive little species is named for Margaret Bohart who, for many years, has shown much generosity and hospitality to Dick's students.

Variation.—Females vary from 2.3 to 2.7 mm. The thorax varies from metallic green to metallic blue. The wing maculations are equally intense on all of the specimens. On several specimens the basal foveae are indicated by a slight depression bordered on the inner side by a short carina; the pit is equal in size or smaller than the spiracle.

Discussion.—This species is similar to *apilosus* in having the basal cell of the forewing nearly asetose and in the carinate pronotum. There are rather striking differences between the species especially in forewing maculations and hindcoxal setae (as stated in the key). The flagellomeres of *margaretae* range from barely longer than wide (F1) to wider than long (F6), whereas in *apilosus,* F1 is nearly 2× as long as wide and F6 is longer than wide. Also in *margaretae* F1 is cylindrical but in *apilosus* it is constricted basally (Fig. 20b). Additionally, the abdomen of *margaretae* is rigid with dull reticulate sculpture somewhat as on the thorax, but in *apilosus* the abdomen is distorted and sunken with shiny, alutaceous sculpture.

Boharticus nanellus Grissell, New Species
(Figs. 1, 14, 18)

Holotype female.—Body length 1.7 mm. Head, thorax, and upper ¾ of hindcoxa metallic green; yellow are: scape, fore and midcoxae (and apex of hindcoxa), legs (except tarsomere 5 dark brown), and abdomen (which is smoky dorsally); wing veins and tegula straw colored; flagellum brown. Head and thorax evenly covered with reticulate sculpture; abdomen evenly covered with reticulations but not as raised as on thorax (also difficult to see with reflected light because of yellow background). Face as shown in Fig. 18; toruli nearly 3× own diameter above ventral margin of eyes (4:11); intermalar distance 2.4× malar distance (22:9); eye 2.4× length of malar distance (22:9); ratio lateral ocellus diameter : ocellocular distance : postocellar distance as 5:10:15; ratio scape : pedicel : anelli : flagellomeres 1–6 : club as 23:8:1:1:5:5:4:4:5:5:12, flagellomeres starting 1× as long as wide (F1 = 5:5) and becoming wider than long (F6 = 6:5). Pronotal collar in dorsal view dropping perpendicularly to the neck but without carina; nucha a narrow carina which is scarcely widened medially, basal and apical fovae about the size of spiracle (not very well developed); 2 or 3 long setae present posterior to spiracle, callus with about 5 or 6 setae; epimeral scrobe poorly defined, situated at midpoint of epimeron and occupying about ⅐ the length; wing veins with ratio of submarginal : marginal : postmarginal : stigmal as 55:30:28:20; wing heavily setose with areas bare as follows: speculum, area beneath cubital vein, basal half of costal cell (except row of setae along lower foremargin); maculations as shown in Fig. 14, weakly expressed and diffuse; hindcoxa with several setae basally. Abdomen

dorsoventrally sunken, with ratio T1–7 : ovipositor sheaths as 16:12:10:10:11:14: 6:1; ratio length : width as 40:32; ratio abdomen : thorax as 40:33.

Allotype male.—Body length 1.5 mm. Color as for female except abdomen metallic reddish. Similar to female (including ratios) except as follows: flagellomeres with recurved setae which are about as long as segment; wing maculation restricted to weak stain posterior to stigma; ratio T1–6 as 14:5:4:4:3:2.

Type material.—Holotype female, USNM #100594; OHIO, *Wayne Co.*, Wooster, 25 June 1961, J. E. Appleby, ex tip midge on *Juniperus horizontalis*. Allotype ♂, 1 ♀, 2 ♂ paratypes same data as holotype; 1 ♀, 1 ♂ paratype same data as holotype except ex *Juniperus virginiana*; 63 ♀, 66 ♂ paratypes, FLORIDA, *Alachua Co.*, Gainesville (Doyle Conner Building), 15–26-XI-1973, E. E. Grissell, sweeping *Juniperus salicicola* (Small) Bailey. Holotype ♀ and paratypes from Ohio in USNM; paratypes from Florida in FSCA, USNM, BMNH, and the Canadian National Collection, Ottawa.

Etymology.—From the diminuative (*-ellus*) of *nanus*—a dwarf, in reference to the small size of this species.

Variation.—Males and females from the Ohio population are generally larger in size than the Florida population. Males from Ohio range in length from 1.3 to 1.5 mm and females are about 1.6 mm long. Females from Florida, however, range in size from 0.8 to 1.5 mm and males from 0.7 to 1.0 mm. The wing maculation varies considerably even within the 3 females from Ohio. In the holotype and 1 female from *J. virginiana* the forewing spot is weak and occupies the anterior half to third of the wing; in 1 female from *J. horizontalis* the spot nearly reaches the hindmargin of the wing (but with a hyaline break at one-third the distance from the posterior margin). Larger females from Florida (ca. 1.5 mm) have the wing spot as for the holotype, but small females (ca. 0.8 mm) have the spot restricted to a weak stain posterior to the stigma. In males the spot resembles that of small females or is absent. In general, as the specimens become smaller (either sex), the yellowish coloring of the abdomen and hindcoxae becomes darker. The mid and forecoxa, legs, and scape remain yellow even in the smallest male. In small specimens, the number of setae in the basal cell is reduced to about 10, but the setae are fairly evenly spaced. In both males and females, the epimeral scrobe may be absent regardless of the size.

Discussion.—This is the smallest species of the genus, being less than 2 mm, and the only species for which the male is known. For a discussion see *B. richardi.*

Boharticus apilosus **Grissell, New Species**
(Figs. 16, 20)

Holotype female.—Body length 3.2 mm. Head and thorax metallic green; scape and abdomen blackish green; legs yellowish orange except femora with greenish reflections, tibiae smoky, foretarsi and mid and hind tarsomeres all darkish brown; antennae, wing veins, and wing maculation brown. Head and thorax evenly covered with reticulate sculpture; abdomen alutaceous. Face as shown in Fig. 20a; toruli 2× own diameter above ventral margin of eyes (3:6); intermalar distance 2.1× malar distance (19:9); eye 2.6× length of malar distance (42:16); ratio of lateral ocellus diameter : ocellocular distance : postocellar distance as 3:6:9; ratio scape : pedicel : anelli : flagellomeres 1–6 : club as 36:10:2:2:11:13:12:12:12:10:20; flagellomeres starting ca. 2× longer than wide (F1 = 11:6) and remaining longer

than wide (F6 = 10:8); F1 constricted at base (Fig. 20b). Pronotal collar dropping perpendicularly to the neck, with carina along anterior margin; nucha a narrow carina which is slightly produced medially to form frail carina which reaches half way to anterior margin of propodeum, basal and apical foveae about size of spiracle (not well developed); ca. 6 long setae present posterior to spiracle, callus with about 10 setae; epimeral scrobe a long, crescentric line reaching from posterior margin to anterior; wing veins with ratio of submarginal : marginal : postmarginal : stigmal as 45:30:25:18; basal cell with 6 to 8 setae, speculum and area below cubital vein bare, costal cell with row of setae along anterior margin on underside and 2 sparse rows in distal ⅓ on underside; maculations as shown in Fig. 16; hindcoxa without setae basally (2 or 3 setae distally). Abdomen keel-shaped, dorsally sunken due to lightly sclerotized terga, with ratio T1–7 : ovipositor sheaths as 18:6:19:9:16:15:9:6; ratio length : width as 49:15; ratio abdomen : thorax as 49:25.

Male.—Unknown.

Type material.—Holotype ♀, USNM #100595; ARIZONA, *Santa Cruz Co.*, Patagonia, 3 October 1946, Nog. #65320, ex "*Juniper berries.*" Paratypes: 5 ♀, same data as holotype. All specimens in USNM.

Etymology.—From *pilosus*—hairy and *a*—without, in reference to the lack of setae on the base of the hindcoxa.

Variation.—The number of setae in the basal cell ranges from 4 to 8. The abdomen of the type is distorted so that T2 and T4 appear shorter than for other specimens. From the specimens at hand, T2–6 may be subequal, or T2 and T4 may be equal and shorter than T3, T5, and T6. The abdomen of this species is weakly sclerotized and tends to shrivel.

Discussion.—*Boharticus apilosus* is the only species of the genus with the first flagellomere constricted basally (Fig. 20b), and also the only one with no setae on the base of the hindcoxa. For additional characters see *B. margaretae.*

Because of the lack of setae on the hindcoxa, this species would key to the genus *Trychnosoma* Graham in Graham's key (1969) to the European Pteromalidae. It differs from that genus, however by the following: 3 denticles in both mandibles (4 on right mandible of *Trychnosoma*), clypeus reticulate (radiating striae in *Trychnosoma*), forewing with maculations (hyaline in *Trychnosoma*), and the supracoxal flange not joining the nucha (joining in *Trychnosoma*).

Rhopalicus **Foerster**

Rhopalicus Foerster, 1856:66, 70.

Type-species: *Cleonymus maculifer* Foerster, 1840. Monotypic.

This genus is known from 4 species as follows: *tutela* (Walker) is Holarctic, *pulchripennis* (Crawford) is primarily confined to the northern Nearctic, and *brevicornis* Thomson and *guttatus* (Ratzeburg) are Palearctic. A fifth species is herein described as new and is found throughout the southeastern Nearctic. *Rhopalicus* may be defined as follows: clypeus emarginate, with 2 well-defined lobes (Figs. 21a, 22a); venter of torulus less than own diameter above line connecting ventral margins of eyes or slightly below; pronotum without carina; thorax not similarly reticulate throughout, at least postalar plate vertically carinate (may appear elongately reticulate towards inner margin and smooth along outer), epimeron may

be smooth above, propodeum nearly shiny or alutaceous medially (but as reticulate as scutellum in *zolae* and some *pulchripennis*); nucha medially expanded as triangular area which narrows to median carina and meets (or nearly) anterior margin of propodeum (Fig. 7); supracoxal flange joined to nucha (as in Fig. 6); forewing with or without maculations; postmarginal and marginal veins longer than stigmal, and postmarginal at least slightly longer than marginal, stigma not enlarged in female, but may be elongate as in Fig. 24c (in male slightly enlarged in *tutela,* Fig. 24a).

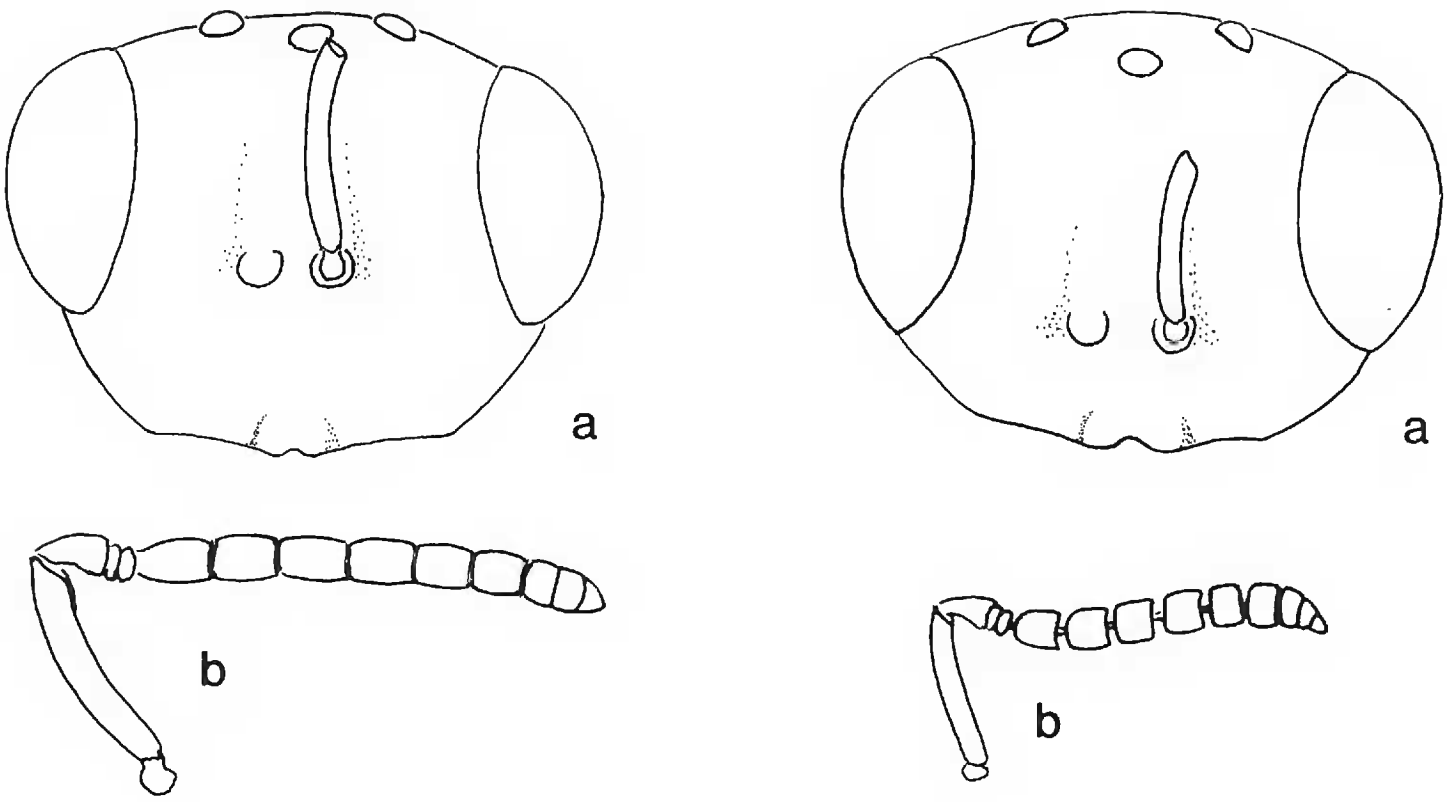
My concepts of the species discussed below are based upon Graham's work (1969: extant types examined), my identification of Palearctic specimens based upon his key, the types of the Nearctic species, and the lectotype of *tutela* (Walker) (BMNH).

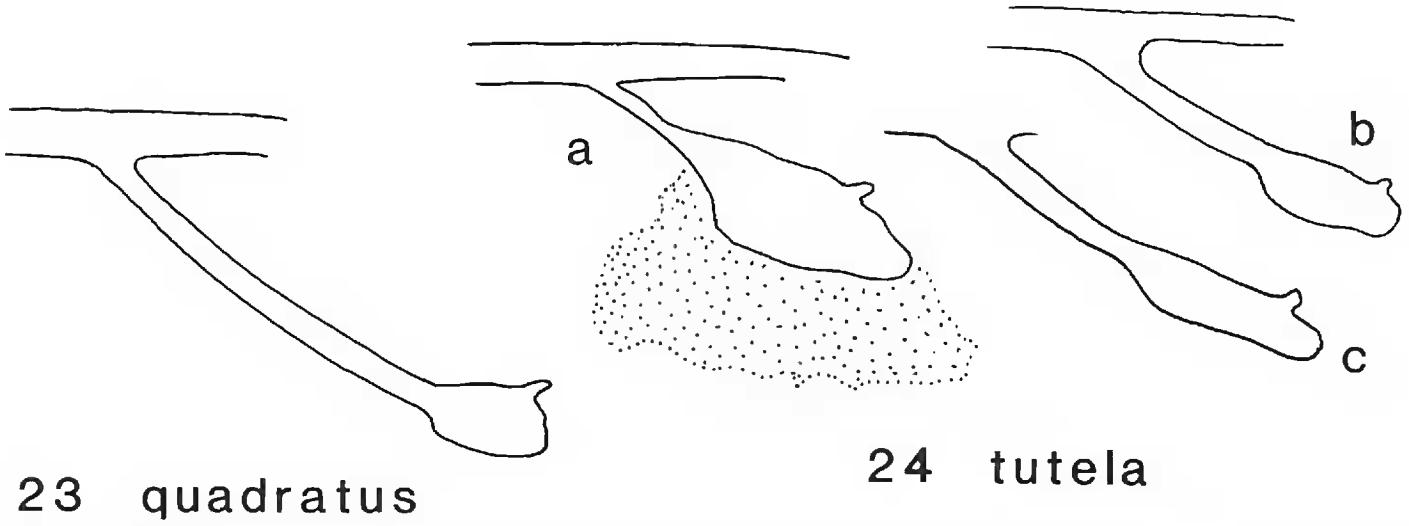
Key to Female *Rhopalicus*

1. Lower surface of forewing costal cell with 2 or more rows of setae in proximal half; upper epimeron smooth; macula of wing (rarely absent) associated with stigma (Holarctic) ..... *tutela* (Walker)
– Lower surface of forewing costal cell with 1 row of setae in proximal half; upper epimeron similarly reticulate to lower portion; macula of wing absent or associated with marginal vein 2
2. Scape length at most ¾ distance between top of torulus and venter of midocellus (Fig. 22a); basal vein without setae (Nearctic) ..... *zolae* Grissell, n. sp.
– Scape length subequal to distance between top of torulus and venter of midocellus (Fig. 21a); basal vein with setae 3
3. Forewing hyaline; flagellomeres 1–6 together shorter than distance between eyes (dorsal view) (Palearctic) ..... *quadratus* (Ratzeburg)
– Forewing with some form of spot; flagellomeres 1–6 together longer than distance between eyes 4
4. Forewing with infumate spot confined to basal half of marginal vein; dorsellum separated from scutellum by pitted groove (Palearctic) ..... *guttatus* (Ratzeburg)
– Forewing with infumate spot beneath entire length of marginal vein; dorsellum continuous with scutellum (at most a weak line delimits the suture) (Nearctic) ..... *pulchripennis* (Crawford)

Rhopalicus zolae **Grissell, New Species**
(Fig. 22)

Holotype female.—Body length 2.7 mm. Head and thorax metallic blue-green; legs, apices of fore and midcoxae, and scape concolorus golden-yellow; flagellum, tegula, and abdomen dark brown; base of fore and midcoxae and entire hindcoxa metallic blue to violet; submarginal and stigmal veins brownish white, marginal, postmarginal, and stigma pale brown. Head and thorax nearly evenly covered with reticulate sculpture (except postalar plate vertically carinate); abdomen weakly sclerotized and shriveled, polished to faintly alutaceous. Face as shown in Fig. 22a; torulus slightly below line connecting ventral margin of eyes; intermalar distance nearly 2× malar distance (17:9); eye 2.3× length of malar distance (21:9); ratio of lateral ocellus diameter : ocellocular distance : postocellar distance as





Figs. 21–24. *Rhopalicus* spp. 21, 22, a = face, frontal view; b = antennae, side view (to same scale as face). 23, 24, stigma and stigmal vein of forewing. 24, a = male; b, c = female showing variation.

6:12:22; ratio scape : pedicel : anelli : flagellomeres 1–6 : club as 26:9:1:2:9:8:7:7:6:6:10, flagellomeres starting 1× as long as wide (F1 = 9:9) and becoming 0.6× as long as wide (F6 = 6:10); F1–6 0.9× distance between eyes dorsally (44:50); scape 0.72× as long as distance between top of toruli and venter of midocellus (26:36) and 0.65× eye height (26:40). Thorax dorso-ventrally flattened, scutellum and scutum in same plane, propodeum with complete median carina; wing veins with ratio of submarginal : marginal : postmarginal : stigmal as 43:16:21:15; basal cell, basal vein, and cubital veins without setae, costal cell with complete anterior row below, and distal half with 1 additional row; weakly defined pale brown spot

present below marginal vein. Abdomen with first tergum 0.14× abdomen length (7:35), abdomen 1.5× longer than wide (35:23) and 1.5× longer than thorax (35:23).

Allotype male.—Length 2.3 mm. Color and sculpture as for female, except pale yellow band present on distal half of tergum I and all of tergum II. Torulus slightly above a line connecting ventral margins of eyes; malar and eye ratios as for female; ratio scape : pedicel : anelli : F1–F6 : club as 30:10:1:2:10:9:8:8:7:7:17; flagellomeres starting 1.4× as long as wide; F1–6 1.13× least interocular distance (27:24); scape 0.84× as long as distance between top of toruli and venter of midocellus (26:31) and 0.70× eye height (26:37). Thorax and propodeum as for female; wing veins with same ratio as female, basal cell with several setae distally and basal vein with row of setae, costal cell as for female except distal half with 3 rows of setae instead of 2. Abdomen with first tergum 0.40× abdomen length (20:50), abdomen 1.7× longer than wide (50:24) and 0.96× as long as thorax (50:52).

Type material.—Holotype ♀ USNM #100695; TEXAS, "Southeast Texas," Mar. 1962 to Oct. 1963, R. C. Thatcher, ex loblolly pine with *Dendroctonus frontalis* Zimmermann. Allotype ♂, 8 ♀ paratypes and 3 ♂ paratypes with same data; 6 paratypes as follows: 1 ♀, MISSISSIPPI, *Amite Co.,* 7 May 1965, N. A. Overgaard, ex pine infested with southern pine beetle; 1 ♀, TEXAS, *Hardin Co.,* June 1960, ex pine infested with *Ips,* Hopkins No. 38912; 1 ♀, GEORGIA, *Dekalb Co.,* Stone Mountain, 26 Oct. 1947, P. W. Fattig; 1 ♀, GEORGIA, *Clark Co.,* Oct. 1965, R. T. Franklin, ex *Ips* infested log of *Pinus echinata*; 2 ♀, NORTH CAROLINA, *Durham Co.,* Durham, 30 May 1942, W. Haliburton, ex *Ips avulsus* LeConte. All specimens in USNM.

Etymology.—Named for my mother who unselfishly supported a young lad's interest in bugs.

Variation.—Females of *zolae* range in length from 2.5 to 3.2 mm. The intensity and size of the forewing maculation varies from an extremely faint stain, confined to the apical fourth of the wing, to a distinct dark spot on the apical fourth which fades gradually and posteriorly to the apical third. The abdomen of all specimens is shriveled, but T1 is about one-sixth the total length and is slightly emarginate posteromedially. In females, the scape ranges from 0.68 to 0.75 times the distance from the top of the toruli to the venter of the midocellus ($n = 10$; $\bar{x} = 0.72 \pm 0.03$); in males the range is 0.84 to 0.87 times the distance ($n = 4$; $\bar{x} = 0.86 \pm 0.01$). In females the length to width ratio of F1 varies considerably and ranges from 0.93 to 1.5 times as long as wide ($n = 10$; $\bar{x} = 1.2 \pm 0.20$). F6 ranges from 0.50 to 0.67 times as long as wide ($n = 10$; $\bar{x} = 0.62 \pm 0.06$). The few males available for study have F1 and F6 relatively longer than females with F1 having a range of 1.4 to 1.7 times longer than wide ($n = 4$; $\bar{x} = 1.5 \pm 0.14$) and F6 0.75 to 0.88 times as long as wide ($n = 3$; $\bar{x} = 0.83 \pm 0.07$).

Distribution.—This species ranges throughout the southeastern United States, from North Carolina south to Georgia and east to Texas.

Hosts.—*Rhopalicus zolae* is associated with pine log rearings usually containing *Ips* and *Dendroctonus frontalis.* One pair of specimens bears the label "ex *Ips avulus,*" but I doubt that the association was actually proven.

Discussion.—Among Nearctic *Rhopalicus, zolae* and *pulchripennis* are superficially similar in appearance. The first species is apparently confined to the southeastern United States, whereas the latter is largely northern in range. The species

do overlap, however, and I have seen a few specimens of *pulchripennis* from Texas and Mississippi. I know of at least two instances where *zolae* has been misidentified as *pulchripennis,* and I am certain that some published records for *pulchripennis* actually refer to *zolae.* This is especially true of papers treating the southern pine beetle, *Dendroctonus frontalis* (e.g., Overgaard, 1968; Moser et al., 1971; Berisford, undated). Specimens (in USNM) reared by Overgaard in Mississippi are *zolae,* but they may have been reported as *pulchripennis* in the paper cited above.

The two species are fairly easily distinguished as follows: *zolae* has the length of the scape at most three-fourths that of the distance to the venter of the midocellus ($\bar{x} = 0.72 \pm 0.03$; range 0.68 to 0.75; $n = 10$) (Fig. 22a), whereas *pulchripennis* has the scape essentially as long as the distance to the midocellus ($\bar{x} = 1.1 \pm 0.08$; range 0.93 to 1.2; $n = 10$) (Fig. 21a). This difference is actually a result of the placement of the toruli of *zolae* at a point slightly below a line connecting the ventral margins of the eyes, whereas in *pulchripennis* the toruli are distinctly above such a line. In *zolae* the flagellomeres are generally wider than long (Fig. 22b) and in *pulchripennis* they are generally longer than wide (Fig. 21b), but measurements tend to overlap on small specimens (ca. 3.0 mm) of *pulchripennis,* thus making this character not reliable in every case. In addition, *zolae* has no setae on the basal vein of the forewing, whereas *pulchripennis* has a row of setae present.

Both *zolae* and the Palearctic species *quadratus* share the shortened scape and flagellomeres just mentioned as well as having a dorsoventrally flattened scutum and scutellum (i.e., both essentially in the same plane). In the Palearctic the degree of convexity of the scutellum can be used to separate species (as, for example, *quadratus* from *guttatus*) but in the Nearctic *pulchripennis* varies enough to make the use of this character difficult within the framework of a Holarctic key.

Rhopalicus quadratus **(Ratzeburg)**

(Fig. 23)

Pteromalus quadratus Ratzeburg, 1844b:203, ♀.
Pteromalus neostadiensis Ratzeburg, 1844b:204, ♀.
Rhopalicus brevicornis Thomson, 1878:43, ♀.

Discussion.—*Rhopalicus quadratus* is the only species with a hyaline forewing. The shortened flagellum (F1–6 shorter than distance between eyes) which separates *quadratus* from *guttatus* and *pulchripennis* is shared with *zolae,* but the two are readily separated by the characters given in the key.

Material examined.—I have seen 37 specimens of this species from Europe (BMNH, USNM).

Distribution.—Northwestern Europe.

Hosts.—Hedqvist (1963:80–81) gave a detailed list of the hosts for this species. All known hosts are Scolytidae of the genera *Tomicus, Carphoborus, Hylurgops, Ips, Orthotomicus, Phloeosinus,* and *Pityogenes.*

Rhopalicus guttatus **(Ratzeburg)**

Ichneumon (*Pteromalus*) *guttatus* Ratzeburg, 1844a:29 (pl. 8, fig. 5), ♀.

Discussion.—This species and *pulchripennis* share the lengthened flagellum (F1–

6 longer than distance between the eyes) and the convex scutellum. I can find no differences between them except those noted in the key.

Material examined.—Thirteen specimens from Europe determined by Boucek (BMNH) and one determined as a homotype by Ruschka (USNM).

Distribution.—Reported from Britain, Germany, Sweden, and Czechoslovakia (Graham 1969:415), and known additionally from Portugal, Yugoslavia, and Turkey (based upon specimens in BMNH).

Hosts.—Hedqvist (1963:82–83) reported that *guttatus* attacked several species of *Pissodes* (Curculionidae), but he discounted a record for *Ips* (Scolytidae).

***Rhopalicus pulchripennis* (Crawford)**
(Figs. 7, 8, 21)

Spintherus pulchripennis Crawford, 1912:168–169, ♀. Holotype ♀, USNM [examined].
Rhopalicus americanus Girault, 1916:296–297, ♀. Holotype ♀, USNM [examined].

Discussion.—Gahan (1924:16) synonymized *americanus* with *pulchripennis*. I agree with this conclusion based upon an examination of the type material. In the Nearctic, *pulchripennis* is the only species to combine both a spot beneath the marginal vein and the presence of setae on the basal vein. For additional remarks see *zolae*.

Material examined.—In addition to the types of *pulchripennis* (7 ♀) and *americanus* (1 ♀), I have examined 123 specimens from North America.

Distribution.—Throughout southern Canada and the northern United States with infrequent (but confirmed) records in Texas, Mississippi, and Virginia.

Hosts.—Recorded from numerous Coleoptera as follows: Scolytidae: *Dendroctonus brevicomis* LeConte, *D. murrayanae* Hopkins, *D. ponderosae* Hopkins, *Pseudohylesinus nebulosus* (LeConte), *Scolytus unispinosus* LeConte; Curculionidae: *Cylindrocopturus eatoni* Buchanan, *C. furnissi* Buchanan, *Pissodes approximatus* Hopkins, *P. strobi* (Peck), *P. terminalus* Hopping. (Records of *pulchripennis* from *Ips* spp. (Overgaard, 1968) and from a combined rearing of *Dendroctonus frontalis* Zimmermann and *Ips* spp. (Moser et al., 1971) probably refer to *Rhopalicus zolae*; see discussion under that species.)

***Rhopalicus tutela* (Walker)**
(Fig. 24)

Cheiropachus tutela Walker, 1836b:14–15, ♂, ♀. Lectotype ♀, BMNH [examined].
Cleonymus maculifer Foerster, 1840:34, ♀.
Pteromalus suspensus Ratzeburg, 1844b:189.
Pteromalus spinolae Ratzeburg, 1844b:189, ♂, ♀.
Pteromalus immaculatus Ratzeburg, 1844b:189, 205.
Pteromalus lunula Ratzeburg, 1848:193, ♀.
Pteromalus multicolor Ratzeburg, 1848:193 [n.n. for *P. spinolae* Ratzeburg 1844b: 189, *nec* Foerster, 1840:23].
Pteromalus aemulus Ratzeburg, 1848:203.
Rhopalicus annellus Thomson, 1878:42, ♂, ♀.

Discussion.—*Rhopalicus tutela* is the largest (to 5 mm) and usually most easily distinguished member of the genus based upon the infumate spot associated with

the stigma (is is especially well developed in the males where it is associated with an enlargement of the stigma, Fig. 24a). Females rarely have the spot reduced or absent and the stigma is nearly always wider than high. In some specimens it may be nearly as long as the stigmal vein (Fig. 24c), while in others it is slightly shorter (Fig. 24b). The stigmal vein is definitely less than twice the length, however, whereas in other species the stigmal vein is 3 or more times the length of the stigma (Fig. 23). This species seems to be distantly related to others of the genus, based upon the stigmal characters and those given in the key.

In 1934 approximately 1500 specimens of this species were introduced from England into Canada for control of the Eastern spruce beetle, *Dendroctonus rufipennis* (Kirby), (reported as *piceaperda* Hopkins: Scolytidae by McGugan and Coppel, 1962); no "evidence of survival" was obtained. According to Britton (1920), however, *R. tutela* (reported as *suspensus* Ratzeburg) was reared in 1914 from *Pissodes strobi* (Curculionidae) in New Haven, Connecticut. Specimens of this rearing are now in the U.S. National Museum and confirm the fact that *Rhopalicus tutela* occurred in the Nearctic before its release from Europe in 1934. It is not known whether *R. tutela* could have been an accidental introduction of earlier times.

Material examined.—In addition to the lectotype (BMNH), I have seen 95 specimens from Europe (BMNH, USNM) and 15 from the northeastern United States (USNM).

Distribution.—*Rhopalicus tutela* is found from the northeastern United States to Quebec and Ontario in Canada (Burks, 1979), is "widely distributed in Europe" (Graham, 1969), and is reported from numerous localities in Japan (Kamijo, 1981).

Hosts.—In the Nearctic, this species has been reared from *Ips pini* (Say) (Scolytidae) and *Pissodes strobi* (Curculionidae). Hedqvist (1963) reported the biology of this species in Europe and gave a complete host list which includes numerous genera and species of Scolytidae as well as 3 species of *Pissodes*. Kamijo (1981) stated that "in Japan this species is commonly found on trunks of pine and larch infested by bark beetles, and to a lesser extent on those of spruce and fir."

Unplaced Species

Rhopalicus pallipes Provancher

Rhopalicus pallpies [sic] Provancher, 1888:407, ♀.

Burks (1964:1261) commented on the validity of this species. The type is lost, and from indications cited by Burks this species is probably an eulophid. The name was spelled *pallipes* in the index to Provancher's work, and this is considered to be the correct spelling.

Dinotiscus Ghesquiere

Dinotus Foerster, 1856:66, 70, 71. Preoccupied by *Dinotus* Guettard, 1770 (*Vermes*). Type-species: *D. bidentulus* Thomson, 1878; designated by Ashmead, 1904: 316.

Dinotiscus Ghesquiere, 1946:370. New name for *Dinotus* Foerster (1856) *nec* Guettard (1770).

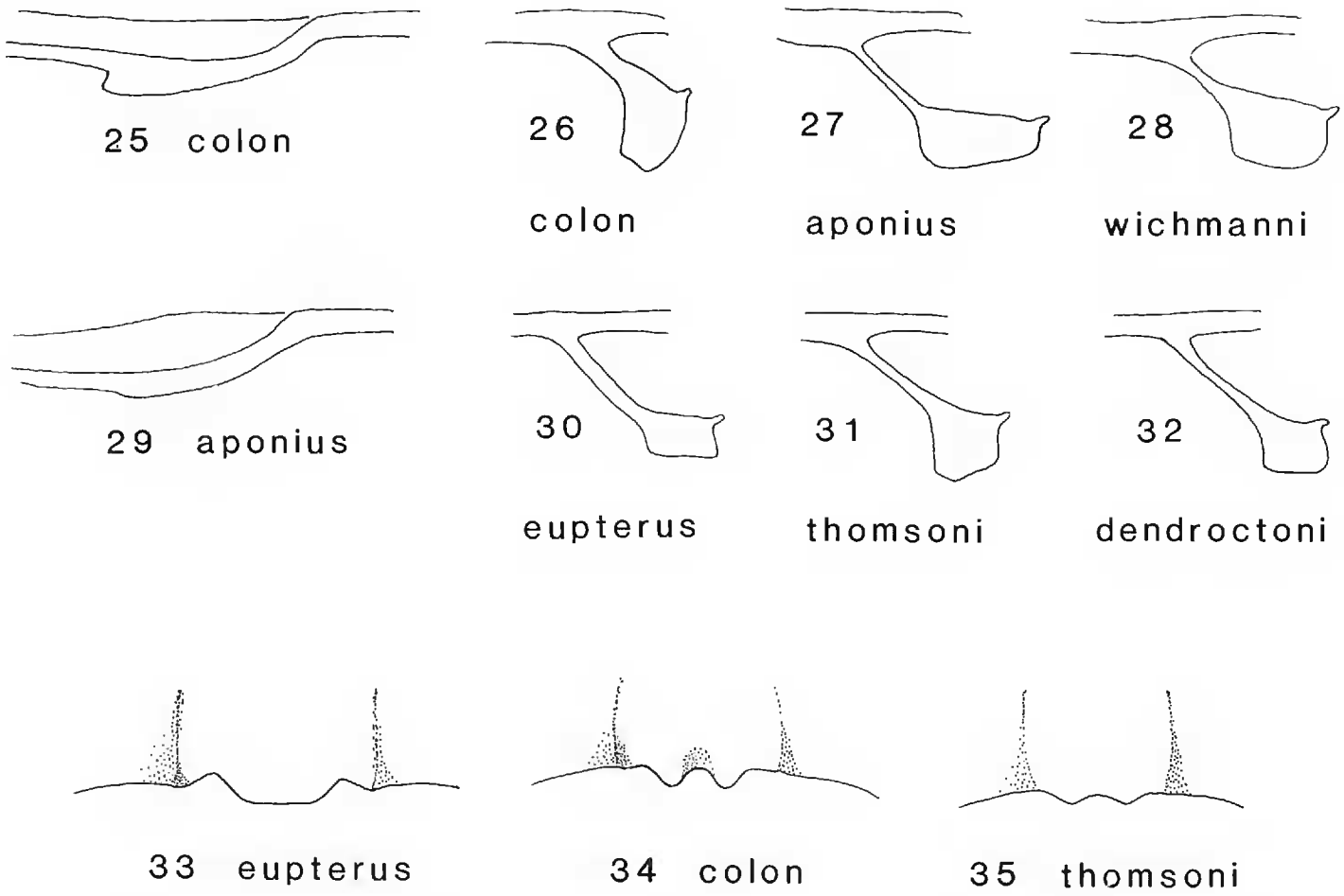
This genus is presently known from 4 Palearctic species (Graham, 1969) and 6 Nearctic ones (Burks, 1979). In this paper, however, the number of previously reported Nearctic species is reduced to 3 and a Palearctic species (*aponius* Walker) is reported as new to the Nearctic fauna. The genus now is made up of 6 species with 2 Palearctic (*colon, wichmanni*), 2 Nearctic (*thomsoni, dendroctoni*), and 2 Holarctic (*aponius, eupterus*).

Dinotiscus may be defined as follows: clypeus variable, either deeply emarginate (with 2 well-defined lobes), with a slight emargination, or straight; venter of torulus usually 1×, and rarely 2×, own diameter above line connecting ventral margins of eyes; thorax not similarly reticulate throughout, postalar plate vertically carinate (Fig. 10; may appear elongately reticulate), epimeron usually smooth above, propodeum nearly shiny or alutaceous medially; nucha merely a parallel sided rim (Fig. 9), rarely intersected medially by a carina; supracoxal flange joined to the nucha (as in Fig. 6); forewing with or without maculations; postmarginal and marginal veins longer than stigmal, postmarginal longer than marginal, stigma may be enlarged.

As with *Rhopalicus,* my concepts of the species are based upon Graham's work (1969), identification of Palearctic specimens based upon his key, and the types of Nearctic species. Unfortunately there do not seem to be an abundance of specific characters with which to separate species of the genus *Dinotiscus.* Although "typical" forms of the stigmal shape are useful overall, the variability of small specimens (which tend to have the stigma disproportionately reduced) detracts from the reliability of this character. I have included illustrations of typical stigmal shapes to aid in recognition of the species (Figs. 26–28, 30–32).

Key to Female *Dinotiscus*

1. Apical free margin of clypeus deeply emarginate, forming 2 lobes laterally (Fig. 34) 2
– Apical free margin of clypeus straight (Fig. 33) or feebly emarginate (Fig. 35) 3
2. Stigma of forewing higher than wide (Fig. 26); basal vein and cell essentially bare (several setae may be present on basal vein); propodeum narrowed medially to ca. ⅓ length of plica (Palearctic) ..... *colon* (Linnaeus)
– Stigma of forewing wider than high (Fig. 27); basal vein and cell with some setae; propodeum medially at least ⅔ length of plica (Holarctic) ..... *aponius* (Walker)
3. Flagellomeres 1 and 2 as long or longer than eye height or scape (each 3 to 4× longer than broad); upper epimeron sculptured much as lower (Nearctic) ..... *dendroctoni* (Ashmead)
– Flagellomeres 1 and 2 shorter than eye height or scape (at most 2.5× as long as broad); upper epimeron smooth 4
4. Stigma of forewing wider than length of stigmal vein from marginal vein to top of stigma (Fig. 28) (Palearctic) ..... *wichmanni* Boucek
– Stigma of forewing narrower than length of stigmal vein from marginal vein to top of stigma (Figs. 30, 31) 5
5. Apical free margin of clypeus feebly emarginate (Fig. 35); prepectus not evenly sculptured, dorsally with a shiny, usually pronounced, groove



Figs. 25–35. *Dinotiscus* spp. 25, 29, parastigmal vein of forewing. 26–28, 30–32, stigma and stigmal vein of forewing. 33–35, apical free margin of clypeus.

paralleling top border, surface of prepectus irregular, not in single plane (Nearctic) ..... *thomsoni* (Crawford)

– Apical free margin of clypeus straight (Fig. 33); prepectus evenly sculptured and essentially in same plane (Holarctic) ..... *eupterus* (Walker)

Dinotiscus colon **(Linnaeus)**

(Figs. 25, 26, 34)

Sphex colon Linnaeus, 1758:571.
Dinotus calcaratus Thomson, 1878:40, ♀.

Discussion.—*Dinotiscus colon* shares the deeply emarginate clypeus with *aponius* from which it may be separated by characters in the key. Females of *colon* tend to have an elongate abdomen which is about 3 times as long as the thorax, whereas in *aponius* the abdomen is at most twice as long. Additionally in *colon* the parastigma proximally forms a right angle with the submarginal vein (Fig. 25), but in *aponius* it gradually merges with the submarginal vein (Fig. 29).

Unfortunately the infumate spots associated with the wing veins are so variable (even among a few specimens) as to be of little practical use. If developed, *colon* has a spot at the parastigma and *aponius* does not.

Material examined.—I have seen 4 specimens of this species from Europe.

Distribution.—Britain, Sweden, Finland, Germany, and Czechoslovakia (Graham, 1969).

Hosts.—Reared from Scolytidae as follows: *Tomicus piniperda* (Linnaeus), *T. minor* (Hartig), and *Ips acuminatus* Gyllenhal (Hedqvist, 1963; reported as *Dinotiscus calcaratus*).

Dinotiscus aponius **(Walker)**

(Figs. 27, 29)

Hetroxys aponius Walker, 1848:127, 215, ♂, ♀. Lectotype ♂, BMNH [examined].
Pteromalus capitatus; Ratzeburg, 1848:196, pl. 3, fig. 7. (? misidentification of *capitatus* Foerster, 1840).
Pteromalus patellatus Ratzeburg, 1848:196.
Dinotus bidentulus Thomson, 1878:39, ♂, ♀.

Discussion.—Graham's (1969:411) citation of *Pteromalus capitatus* as being described by Ratzeburg (1848) is in error. Ratzeburg correctly cited the specific name as "32. *P. capitatus* Först. (T. III. F. 7.)." However, under this species name, Ratzeburg suggested that his specimens might represent a new species in which case he proposed the name *patellatus*; the description and diagnosis validate this name. According to Graham (1969:411), the illustration in Ratzeburg (T. III. F. 7.) probably refers to what is currently called *Dinotiscus aponius* (Walker) and I agree with this assessment. The wing venation is fairly diagnostic for the species. As the specimens which Ratzeburg saw are presumably destroyed, the association of names is provisional.

For comparative comments on this species see the key and discussion section for *D. colon*. *Dinotiscus aponius* is apparently widespread in Europe and is reported for the first time in the Nearctic as a possible parasite of the smaller European elm bark bettle (see hosts).

Material examined.—Forty-four Palearctic specimens (BMNH, USNM) determined by Ruschka and Boucek; 3 female specimens from Detroit, Michigan determined by Burks and confirmed by me. These latter specimens represent the only record for this species in the Nearctic.

Distribution.—Northwestern and Central Europe (Graham, 1969), Japan (Kamijo, 1981), and Michigan, U.S.A.

Hosts.—As summarized by Graham (1969), *D. aponius* in Europe attacks scolytids as follows: *Scolytus rugulosus* Ratzeburg, *S. multistriatus* (Marsham), *S. ratzeburgi* Jansson, and *Hylesinus varius* (Fabricius) (reported as *fraxini* Panzer). In the Nearctic, this species has been reared from elm infested with *Scolytus multistriatus* (8 May 1973). According to Kamijo (1981) *aponius* appears to attack scolytids on broad-leaved trees.

Dinotiscus dendroctoni **(Ashmead)**

(Fig. 32)

Cecidostiba dendroctoni Ashmead, 1874:337, ♀. Lectotype ♀, herein designated, USNM.
Cecidostiba burkei Crawford, 1912:170, ♀. Holotype ♀, USNM [examined]. **New synonymy.**

Discussion.—Ashmead's *dendroctoni* was described from an unspecified number of "specimens" in the U.S. National Museum. In the museum there are 3 specimens with red type labels. According to the type catalog, 2 specimens were

originally logged as "types" in 1894 and a 3rd was labeled "type" by Gahan in 1928. As the species has had no official "type" designation, I have selected as lectotype 1 of the 2 specimens originally registered in the type catalog. This specimen has the head, wing, and antennae mounted on a slide. The specimen labeled by Gahan as the 3rd type is one of a series on 9 pins (some with multiple specimens) all bearing similar labels stating "Check list No. . . . , Det. by . . . ." These may or may not actually have been examined by Ashmead and their status is questionable. Whatever the status of these specimens, 2 were taken from the series by Crawford (1912) and described as *Cecidostiba ashmeadi* which is a synonym of *D. eupterus.* All the other specimens are *eupterus* as well.

Crawford (1912) separated his species *burkei* from Ashmead's *dendroctoni* based upon the supposedly longer postmarginal vein of the former. He had only the holotype female for measurement. I have measured this specimen and the postmarginal is 1.3× the marginal, while in the lectotype of *dendroctoni* it is 1.2×. In a reared series of 10 females from Colorado, the postmarginal ranges from 1.2 to 1.4× the marginal and *burkei* easily falls within this range. I consider them to be synonyms, especially based upon the following autapomorphies which define the species: the flagellomeres are all much longer than wide (ca. 3 to 4×), with F1 and F2 together longer than either the scape or the eye height (in other *Dinotiscus* F1 and F2 are shorter than the eye height or scape, and each flagellomere is rarely up to 2.5× longer than wide); the upper and lower epimeron are similarly sculptured (upper epimeron polished in other species); and the last tergum is longer than the postmarginal vein (noticeably shorter in other species). I have seen a few specimens from Mexico (Chapingo; Coatepede) which agree with the above, but the upper epimeron is sculptured only medially and is polished around this area. These are the only specimens of *Dinotiscus* known from south of the United States. I think additional specimens are needed to assess their status in relation to typical *dendroctoni.*

Material examined.—In addition to the type series I have seen 80 specimens of *dendroctoni.*

Distribution.—This species has been reported from British Columbia south to New Mexico, Texas (and possibly Mexico), and east to Virginia (Burks, 1979).

Hosts.—*Dinotiscus dendroctoni* is known from the following hosts (Burks, 1979): *Cylindrocopturus furnissi* Buchanan, *Dendroctonus brevicomus* LeConte, *D. rufipennis* (Kirby), *D. frontalis* Zimmermann, *D. ponderosae* Hopkins, *D. pseudotsugae* Hopkins, *Ips grandicollis* (Eichhoff), and *Polygraphus rufipennis* (Kirby). The specimens from Mexico were associated with *Pinus montezumae.*

Dinotiscus wichmanni **Boucek**

(Fig. 28)

Dinotiscus wichmanni Boucek, 1967:635–636, ♀, ♂.

Discussion.—This species closely resembles *eupterus* and differs primarily by the enlarged stigma (stigma wider than length of stigmal vein in *wichmanni* but narrower in *eupterus,* cf. Figs. 28 and 30).

Material examined.—Forty-eight specimens from Yugoslavia, identified by Boucek (BMNH).

Distribution.—Austria (Boucek, 1967) and Yugoslavia.

Hosts.—Known from *Hylastinus obscurus* (Marsham) (Scolytidae) on *Cytisus laburnum* Linnaeus and *Viburnum lantana* Linnaeus, and from *Hylastinus frankhauseri* Reitter on *Cytisus*.

Dinotiscus thomsoni **(Crawford)**

(Figs. 9, 10, 31, 35)

Cecidostiba thomsoni Crawford, 1912:171, ♀, ♂. Lectotype ♀, herein designated, USNM.

Discussion.—This species was described from "6 female and 6 male specimens selected from a large series" now housed in the U.S. National Museum. From among these, I have designated a female as lectotype. *Dinotiscus thomsoni* is somewhat aberrant by virtue of its modified prepectus (i.e., fairly irregular in surface contour and sculpture, with a smooth groove paralleling the dorsal margin) and its slightly emarginate clypeus. Also, the stigma is produced angularly on the inner ventral margin (Fig. 31) which is generally characteristic for the species. The toruli are situated above the ventral margins of the eyes by a distance about 1.5 times their own diameter which is an additional character to separate *thomsoni* from *eupterus* (situated less than own diameter above ventral eye margin).

Material examined.—In addition to the type series I have seen about 60 specimens of this species.

Distribution.—So far restricted to the northwestern United States.

Hosts.—*Dinotiscus thomsoni* is known from *Pissodes* sp. (Curculionidae), *Phloeosinus* sp. (new record), and *Scolytus ventralis* LeConte (Scolytidae).

Dinotiscus eupterus **(Walker)**

(Figs. 30, 33)

Pteromalus eupterus Walker, 1836a:482, ♀. Lectotype ♀, BMNH [examined].
Pteromalus dimidiatus Walker, 1836b:12, ♀. Lectotype ♀, BMNH [examined].
?*Pteromalus capitatus* Foerster, 1840:21, ♂.
Pteromalus lanceolatus Ratzeburg, 1848:204, ♂, ♀.
Dinotus clypealis Thomson, 1878:40, ♂, ♀.
Dinotus acutus Provancher, 1887:201, ♀. **New synonymy.**
Cecidostiba polygraphi Ashmead, 1894:338, ♀, ♂. Lectotype ♀, herein designated, USNM. **New synonymy.**
Cecidostiba ashmeadi Crawford, 1912:170–171, ♀. Holotype ♀, USNM [examined].
Uriella pityogenis Ishii, 1939:189, ♂, ♀.

Discussion.—Burks (1964) saw the type of *acutus* and stated that *ashmeadi* Crawford was a synonym. I have not seen the Provancher type, but I accept Burks' placement. I have compared the known type material of *polygraphi* Ashmead (2 ♀, 1 ♂ syntypes) with *ashmeadi* Crawford (holotype and paratype) and find them identical. Unfortunately only the paratype of *ashmeadi* is in good enough condition to be of value. I hereby designate the better of the 2 females of *polygraphi* Ashmead as lectotype and have placed a label to this effect on the specimen.

This species and *dendroctoni* are the two most commonly encountered species in the Nearctic. Both are widespread and parasitize numerous scolytid hosts on

coniferous trees. The characters used to separate *eupterus* are given in the key and an additional one is given in the discussion of *thomsoni*.

Material examined.—My concept of this species is based upon an examination of about 80 specimens (USNM, BMNH), the lectotype series of *P. eupterus* (BMNH), and the type series of *C. polygraphi* and *C. ashmeadi* (USNM).

Distribution.—This species is now considered to be Holarctic. The Nearctic distribution includes Nova Scotia and Quebec south to Virginia and along the northern United States to Oregon and California. The Palearctic records include Great Britain, Sweden, Germany, and Central Europe (Graham, 1969), and Japan (Kamijo, 1981).

Hosts.—In the Nearctic this species has been reared from Scolytidae as follows (Burks, 1979): *Dendroctonus ponderosae* Hopkins and *Polygraphus rufipennis* (Kirby). Palearctic hosts include scolytid species in the genera *Polygraphus, Phthorophloeus, Cryphalus, Pityophthorus, Pityogenes,* and *Dryocoetes* (Graham, 1969), and *Ips* (Kamijo, 1981).

Unplaced Species

Dinotus elongatus Ashmead

Dinotus elongatus Ashmead, 1888:175, ♀. Holotype ♀, USNM [examined].

I have examined the single holotype female specimen of this species and it is definitely not a *Dinotiscus*. The pronotum lacks a transverse carina, and the propodeum has a well developed, reticulate nucha. The type is fairly fragmentary, but it should be placed near genera such as *Dinarmus* Thomson or *Heteroschema* Gahan based on the structure of the propodeum.

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